Eastern Snake Plain Aquifer Ground Water/Surface Water Interaction

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Introduction

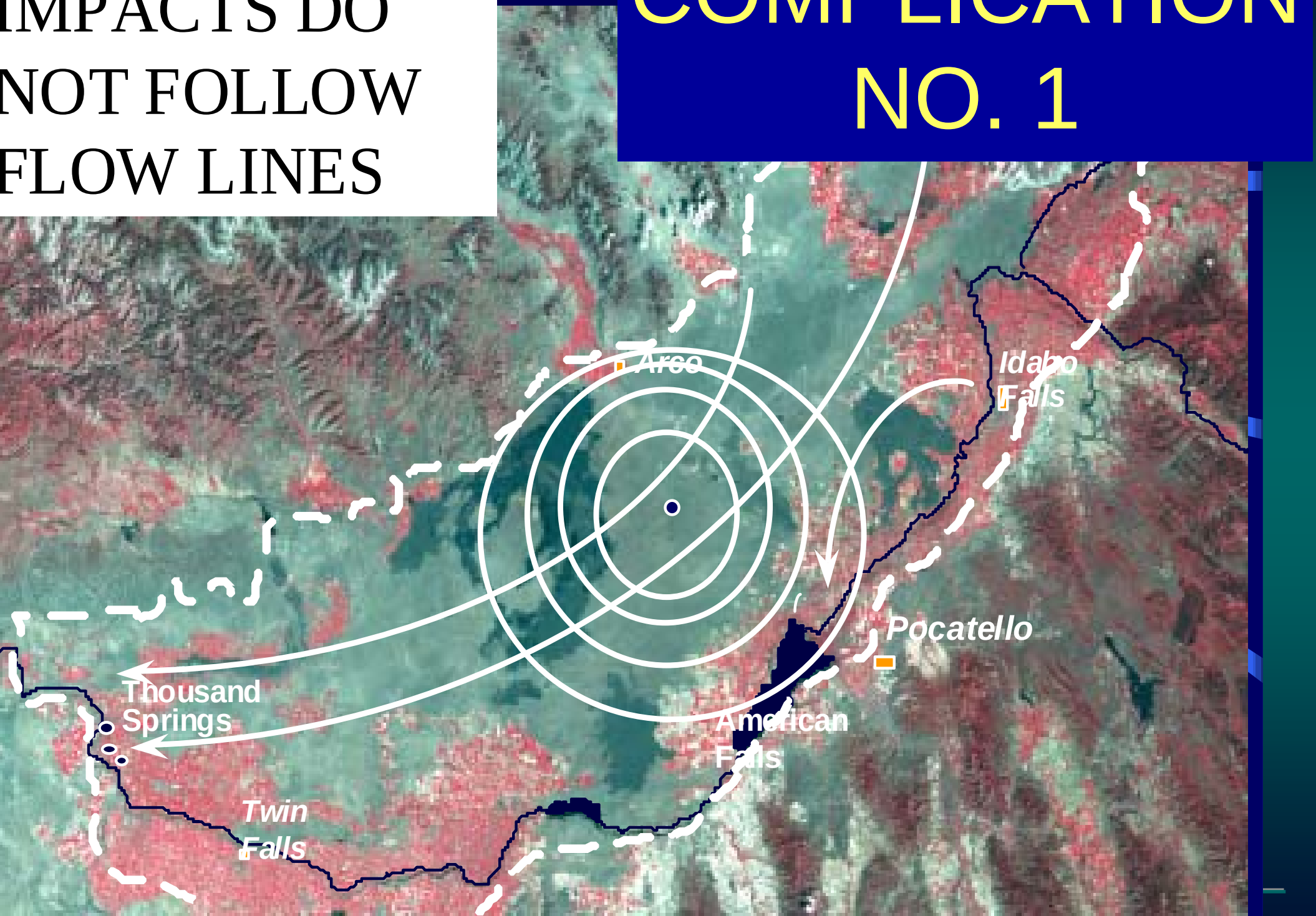
- Why is Conjunctive Management Difficult?
- Characterizing Basins
- Response Functions
- Snake Plain Experience
- Thoughts on Conjunctive Management

Difficulties of Conjunctive Management

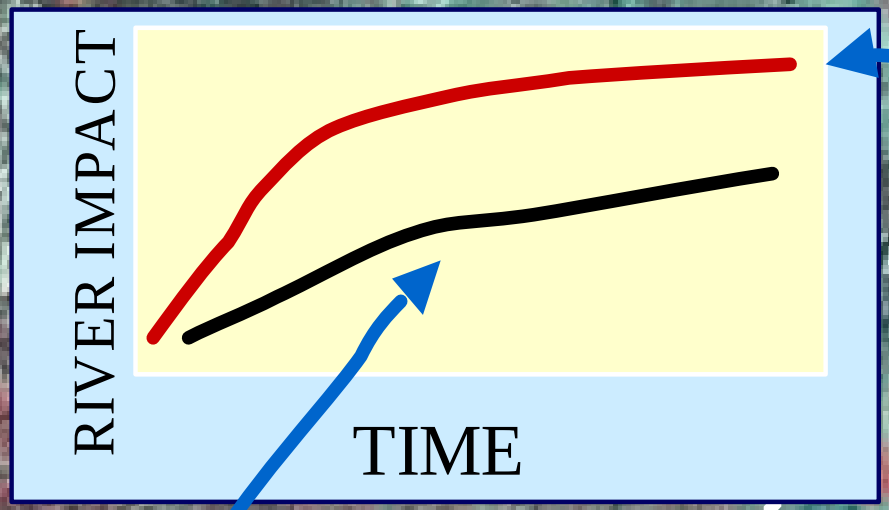
- Surface to Surface Disputes Visible
- Ground to Surface Disputes Invisible
  - Impacts Take Long Time to Propagate Through Aquifer
  - Impacts Propagate Both ‘Upstream’ and ‘Downstream’
  - Impacts Greatly Attenuated
  - Impacts DO NOT Equate to Injury

COMPLICATION NO. 1

IMPACTS DO NOT FOLLOW FLOW LINES



COMPLICATION NO. 2: TIME ATTENUATED IMPACTS



Arco

Idaho Falls

Pocatello

Thousand Springs

American Falls

Twin Falls

Difficulties of Conjunctive Management (cont'd)

- Senior Ground-Water Impacts Arrive Earlier Than Junior
- Curtailment Probably Triggers 'Futile Call'
- Injury is Seasonal, Impacts are Year-Round
- Difficult to Isolate Impacts from Pumping from Impacts from Other Sources (Conversion to Sprinkler, Drought)

Difficulties of Conjunctive Management (cont'd)

- Because of These Difficulties, Resources Traditionally Not Conjunctively Managed

Can We Characterize Basins Well Enough?

- Can Never Perfectly Characterize Basins
  - Highly Complex
  - Never Enough Data
- Solid Understanding of Water Supply and Major Hydrologic Interactions Should Suffice
  - Presumes at least a Basic Understanding of the Hydrology
  - Presumes as Accurate a Water Budget as Possible

Can We Characterize Basins Well Enough? (cont'd)

- This has Traditionally Been the Excuse for not Conjunctively Managing
- Rallying Cry of the Ground-Water Users

So, What do we do?

- Characterize to Best of Our Ability
- Build Tools (models) which can Predict Timing and Location of Impacts

- We Promote use of Superposition to Isolate Impacts of Pumping From All Other Impacts

Response Functions

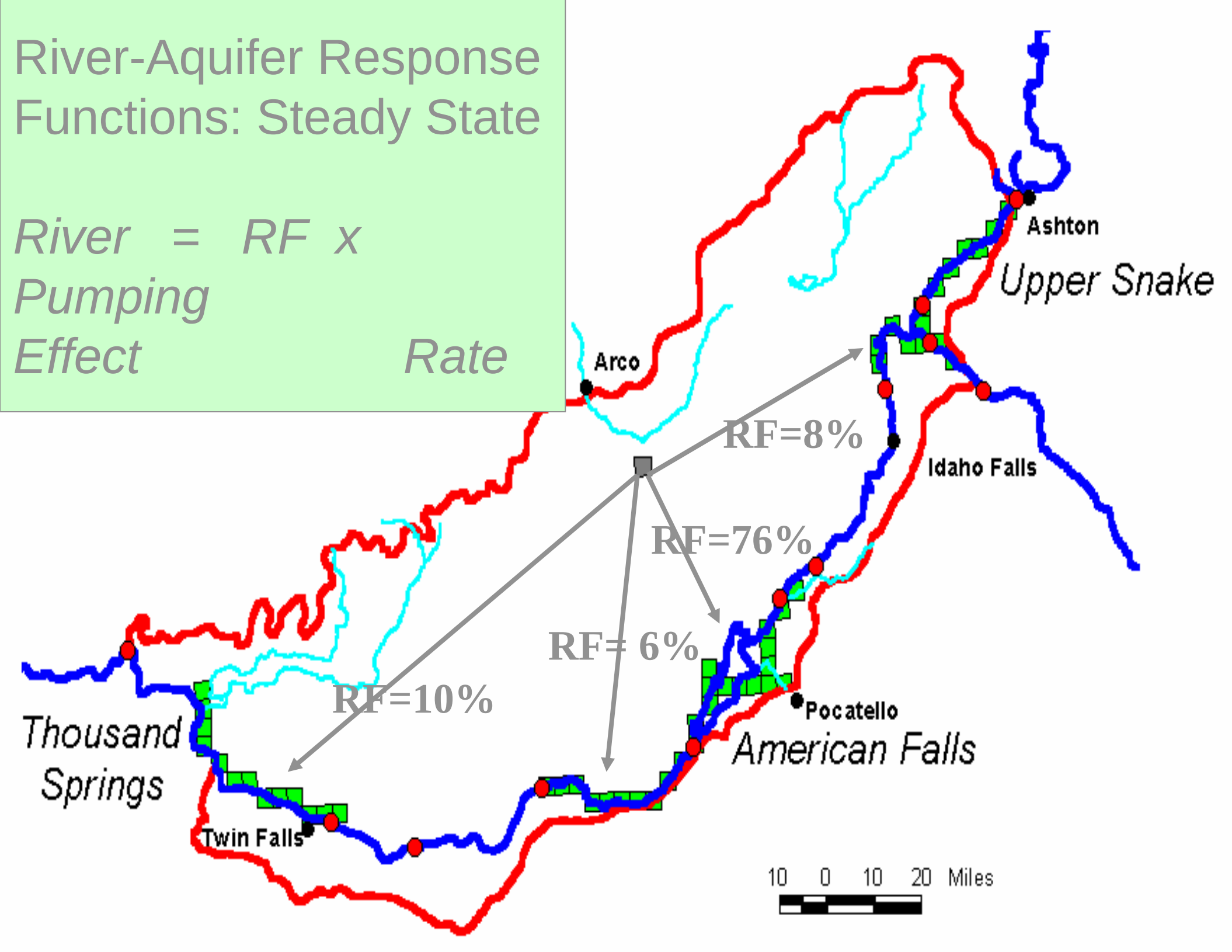
- Based on Principles of Superposition
  - For Linear Systems, Solution to Whole Problem is the Sum of the Solutions to the Parts of the Problem
  - Can Scale and Sum Individual Responses to Generate Complex Scenario
- We Use a Ground-Water Model
  - Relationships Between Stress (Pumping) at an Individual Location and Response at Hydraulically Connected River Reach

Response Functions (cont'd)

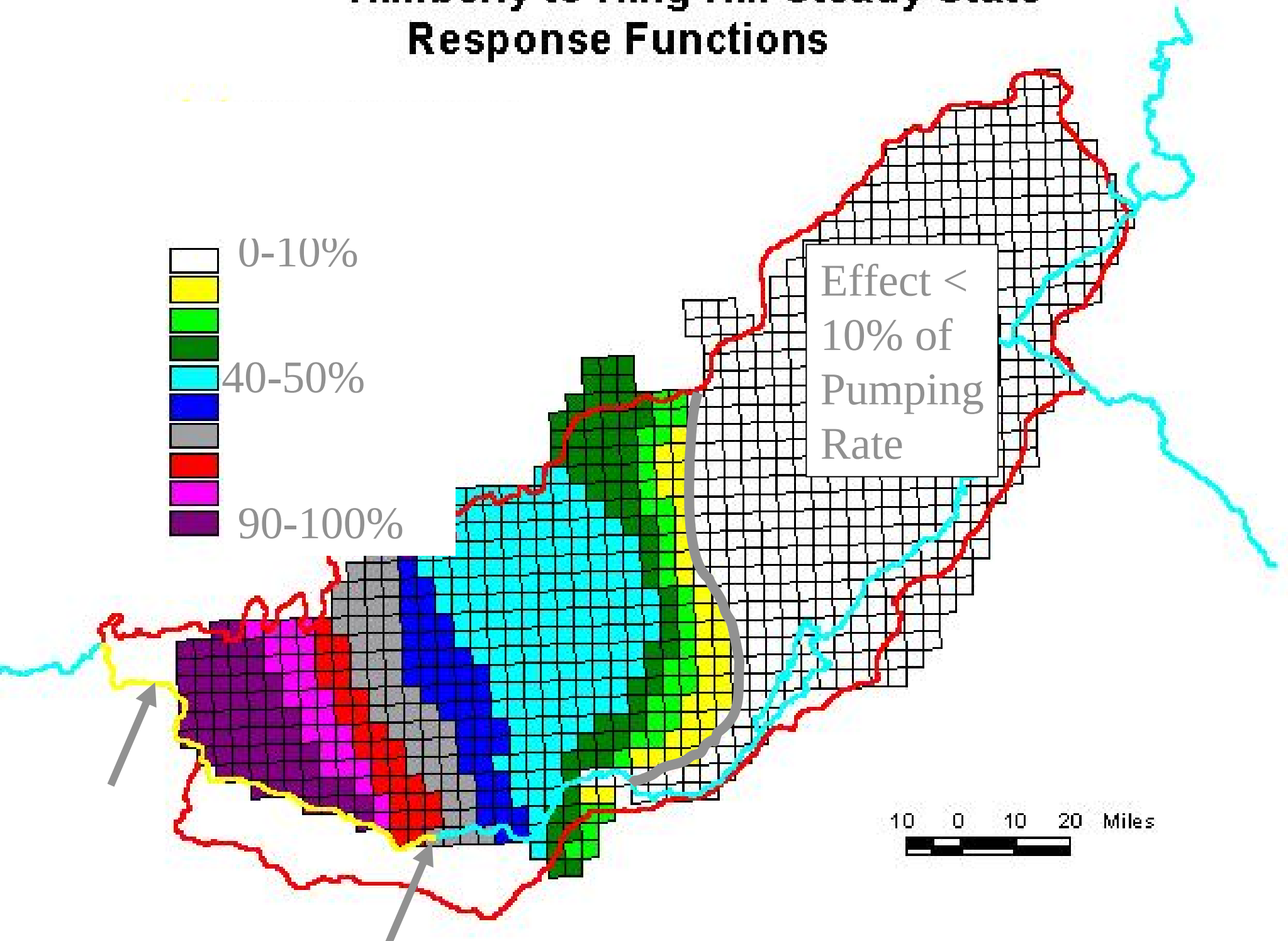
- Enables Evaluation of Single Stress in Isolation of Other Stresses
  - Can Isolate Impacts of Ground-Water Pumping
  - No Interference With Precipitation, Canal Lining, etc.
- Provides Flexibility in Model Use

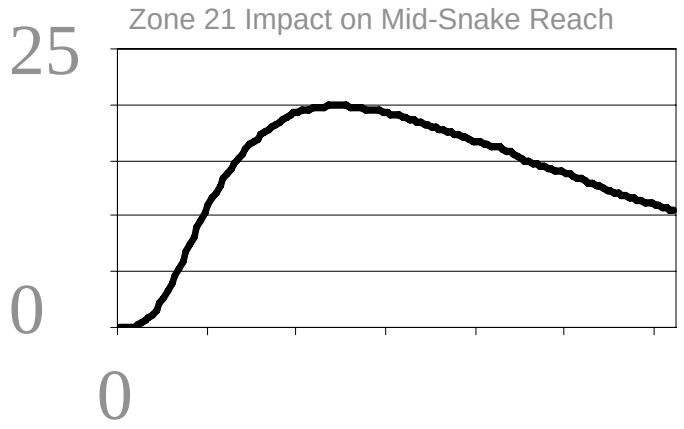
River-Aquifer Response Functions: Steady State

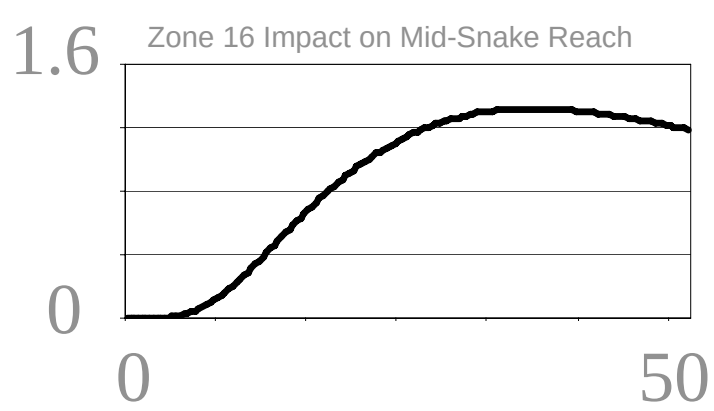
River = RF x Pumping Effect Rate

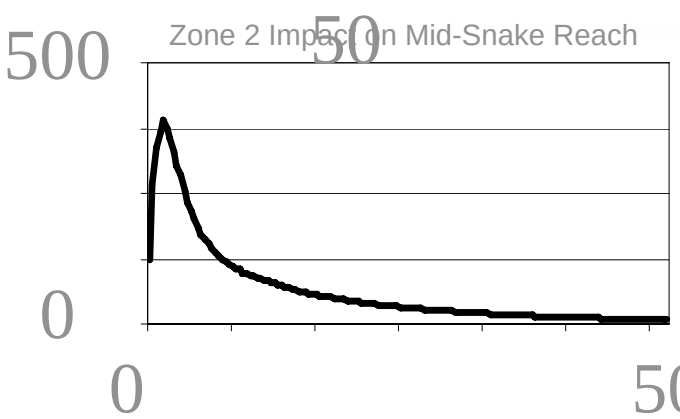


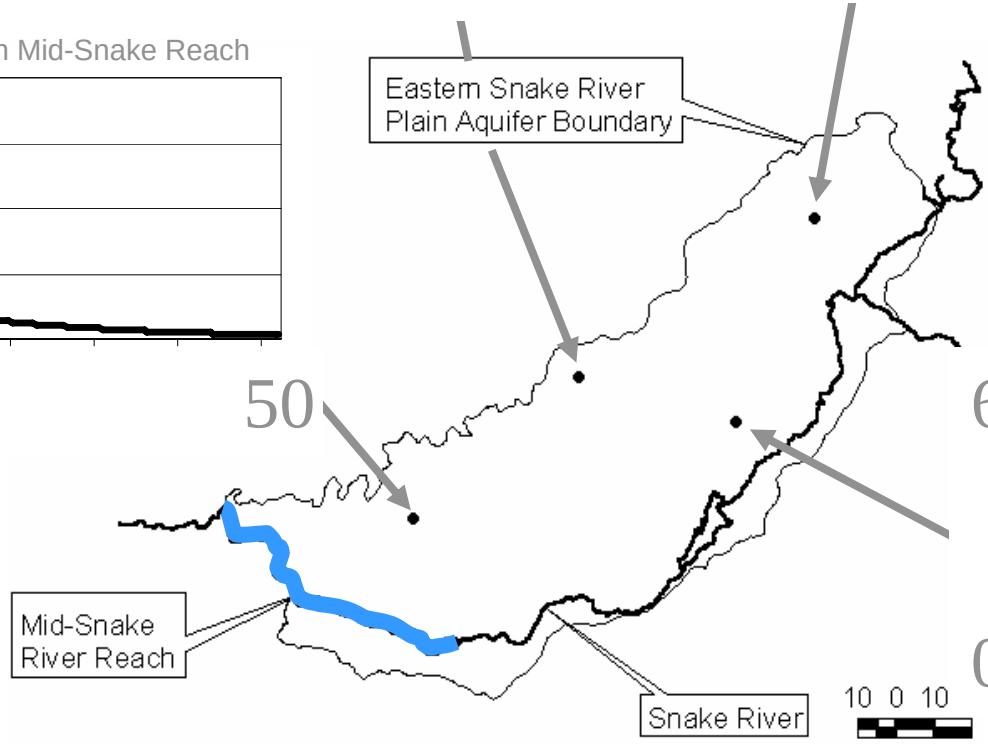
Kimberly to King Hill Steady State Response Functions

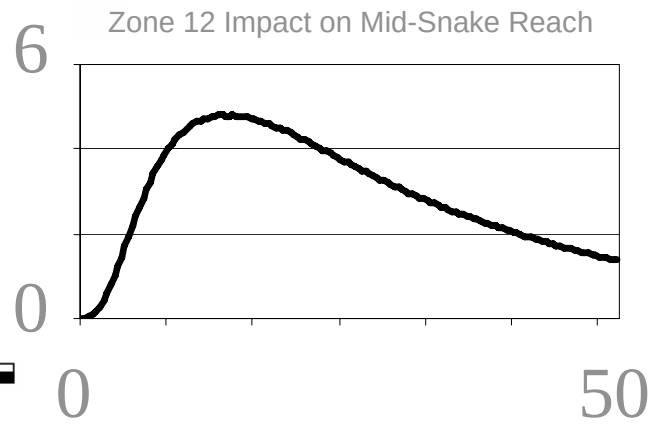










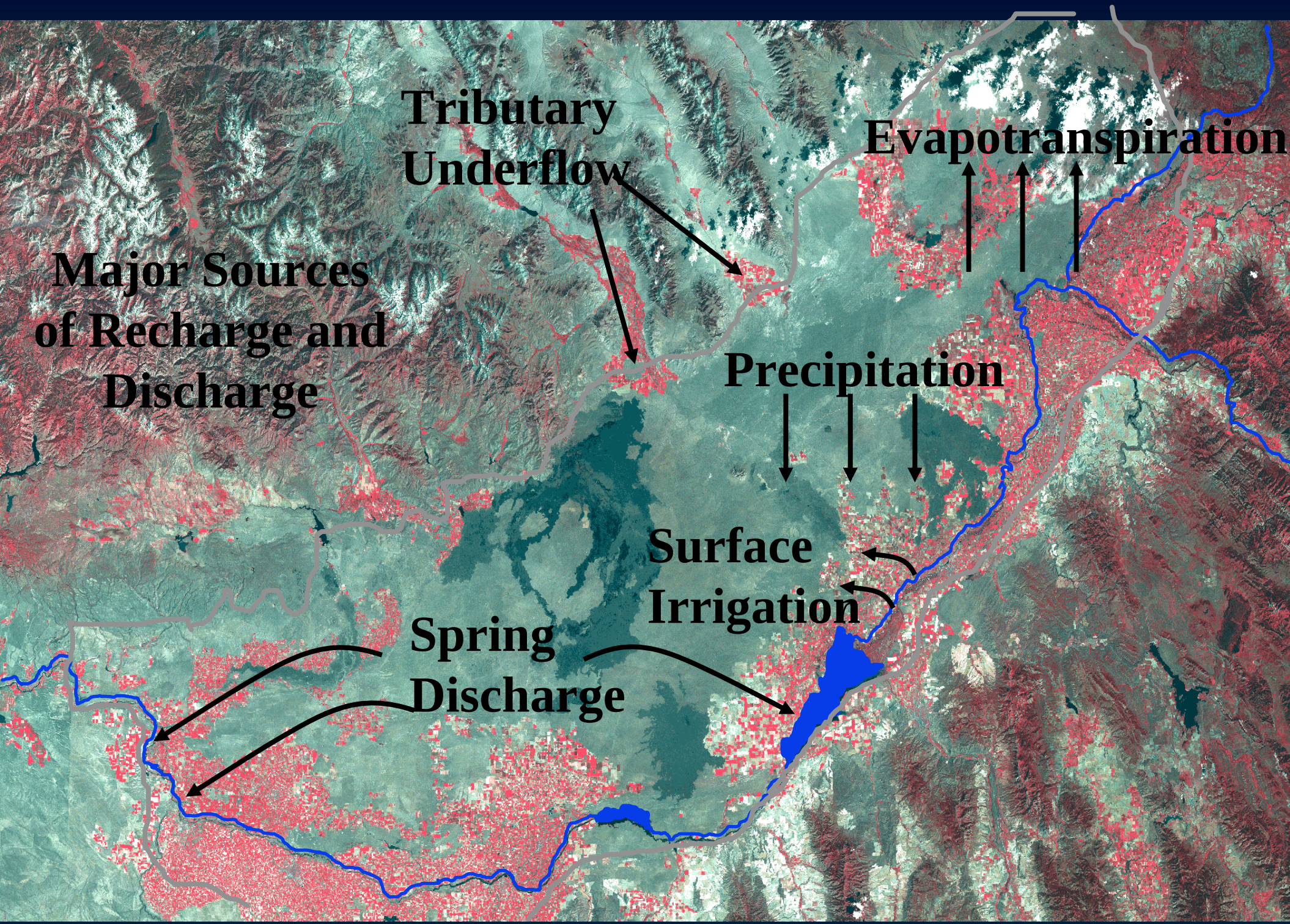


Transient Response Functions

What's Been Going on in the Snake Plain?

Some Hydrologic Background

- Flow Generally NE to SW
- Approximately 6.6 million acre-feet of recharge to aquifer annually
- Two large sections of Snake River hydraulically Connected
- Primary Discharge is to Springs in the Snake River


Tributary Underflow
Evapotranspiration
Major Sources of Recharge and Discharge
Precipitation
Surface Irrigation
Spring Discharge

Some Historic Background

- Onset of Surface Water Irrigation (1900) Raised Water Levels
  - Sometimes hundreds of feet
  - New Springs Formed, Rights Immediately Claimed
  - Continued to 1950s

Some Historic Background (cont'd)

- Then, Several Things Happened
  - Rural Electrification
  - Deep Pumping Technology
    - Pumpers offered discounted electricity
  - Installation of Sprinkler Systems
  - 'Conservation' Methods (canal lining, capturing of return flows, etc)
- Water Levels Started Dropping
- Then Drought Happened

- So, we have Declining Water Levels Caused By:
  - Natural Precipitation Declines
  - Water Economy and Irrigation Efficiency
  - Ground-Water Pumping
- And, We have Pretty Old Rights on Water That Was Not There to Start With (Springs)
- And, So Far, Nobody is Thinking About Species Protection

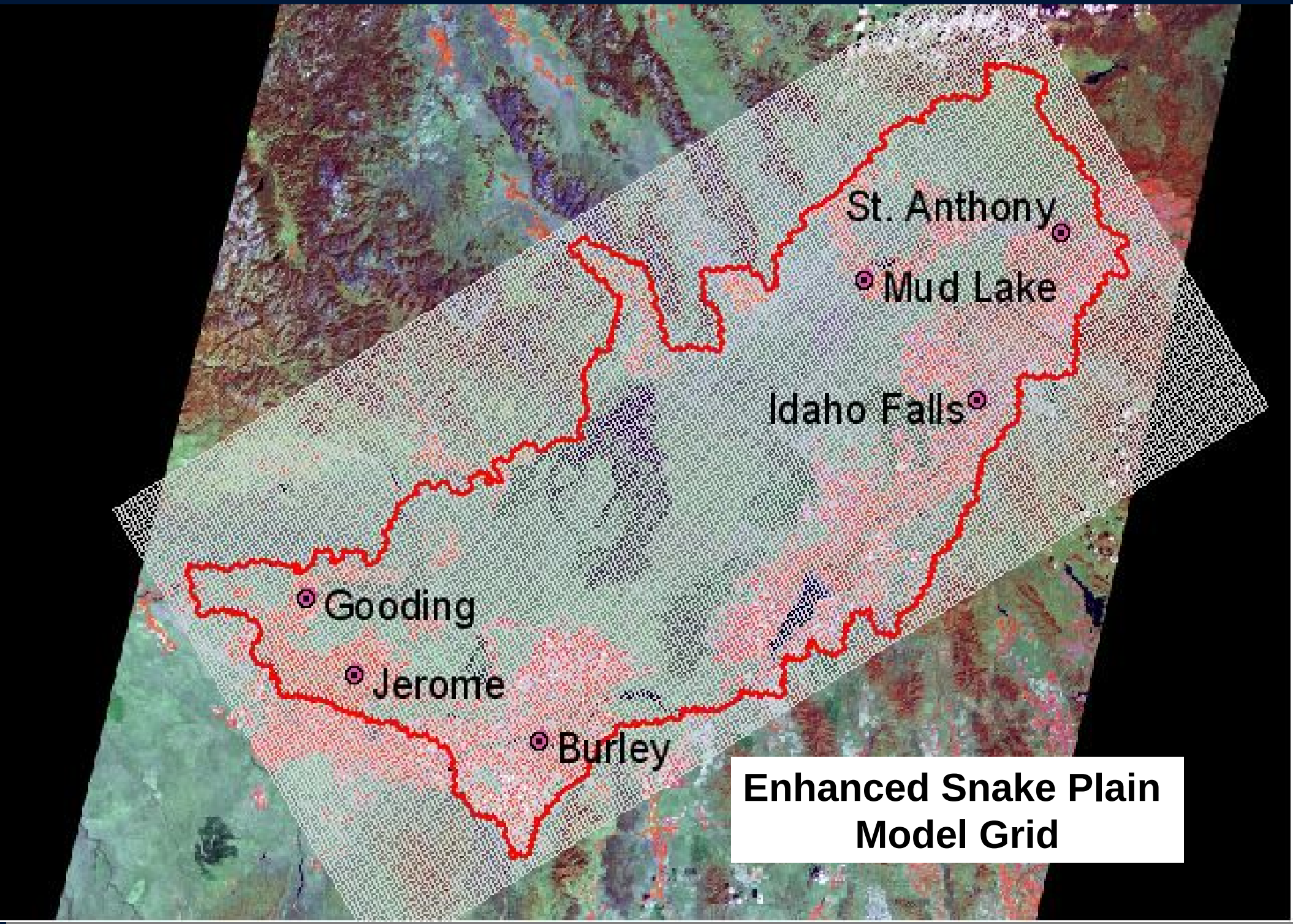
Major Players

- Surface Water Diverters
  - Generally Senior Rights
  - Pretty Well Organized
  - Hurt by Recent Declines in Flows
  - BUT: Guilty of Acreage Enlargements
- Power Generators
  - Medium to Senior Rights
  - Settled for Minimum Flows in ‘Swan Falls Agreement’
  - Now Claiming that Managed Recharge Hurts Their Rights

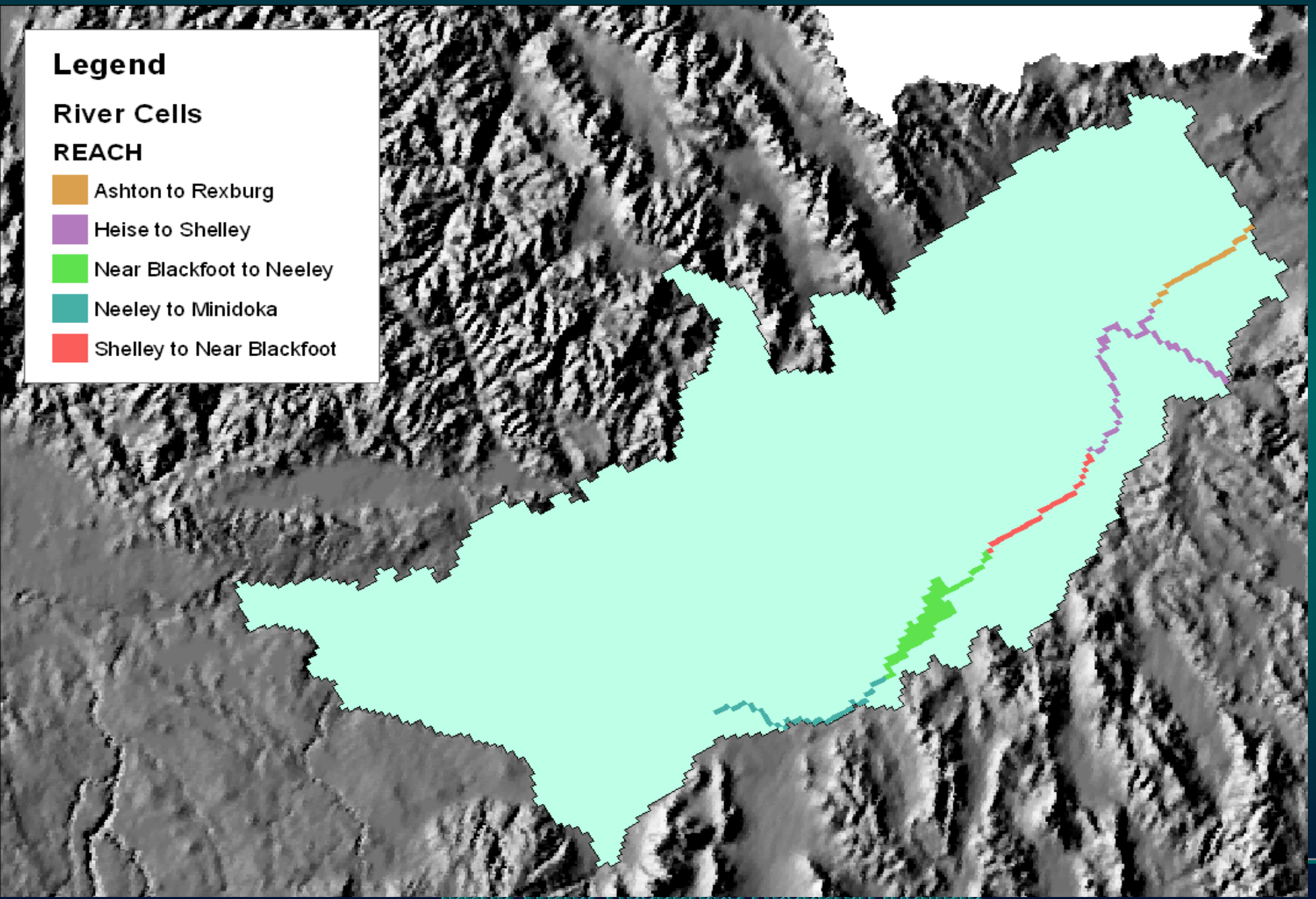
Major Players

- Spring Users
  - Largely Aquaculture Industry
  - Medium to Senior Rights
  - Hurt by Recent Declines in Flows
  - Highly Vocal
  - Some Rights Very Old and Very High Elevation
- Ground-Water Pumpers
  - Relatively Junior Rights
  - Not Well Organized
  - Have NEVER Been Managed

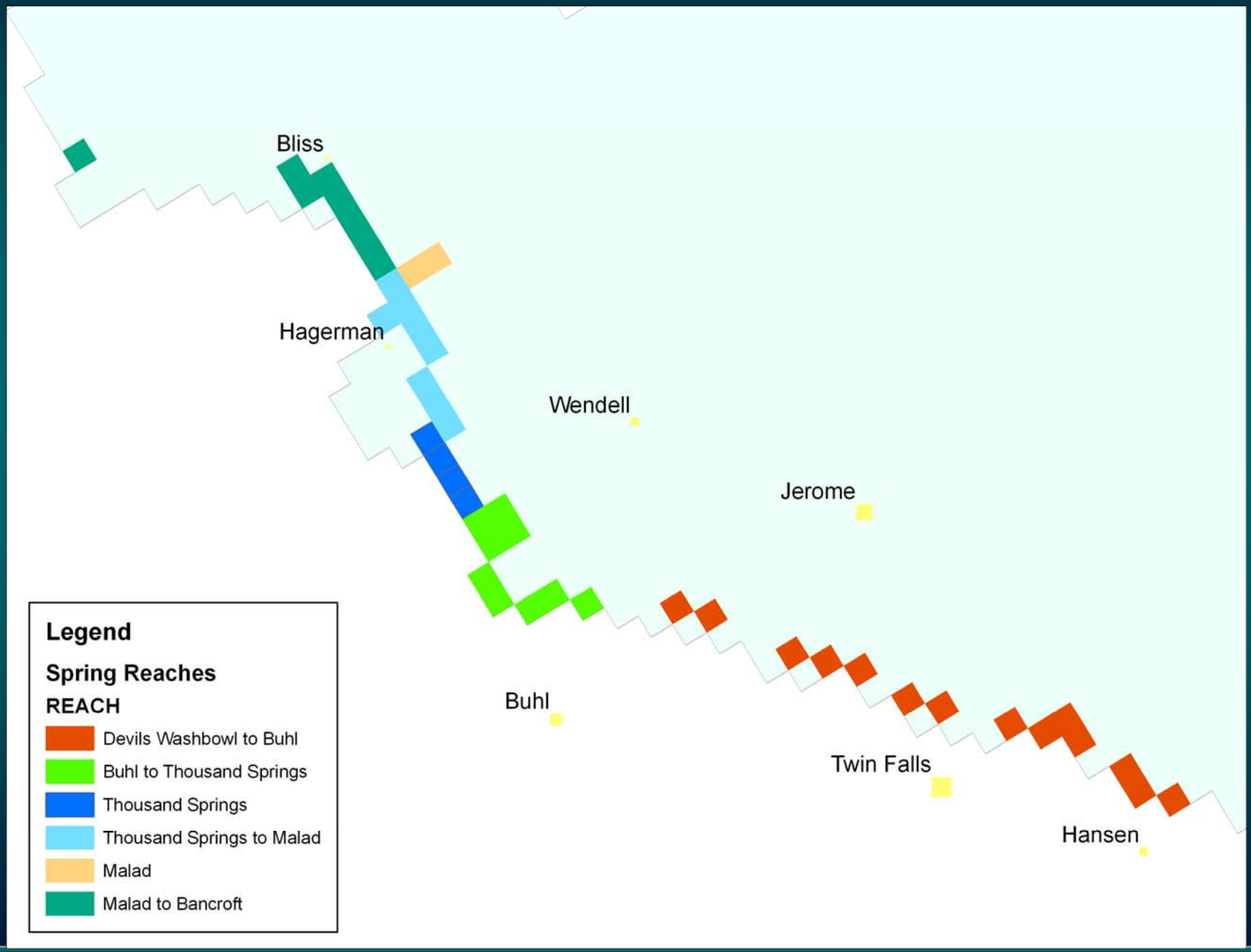
- Some Snake Plain Maps and Photos


St. Anthony
Mud Lake
Idaho Falls
Gooding
Jerome
Burley
Enhanced Snake Plain
Model Grid

Snake River Representation

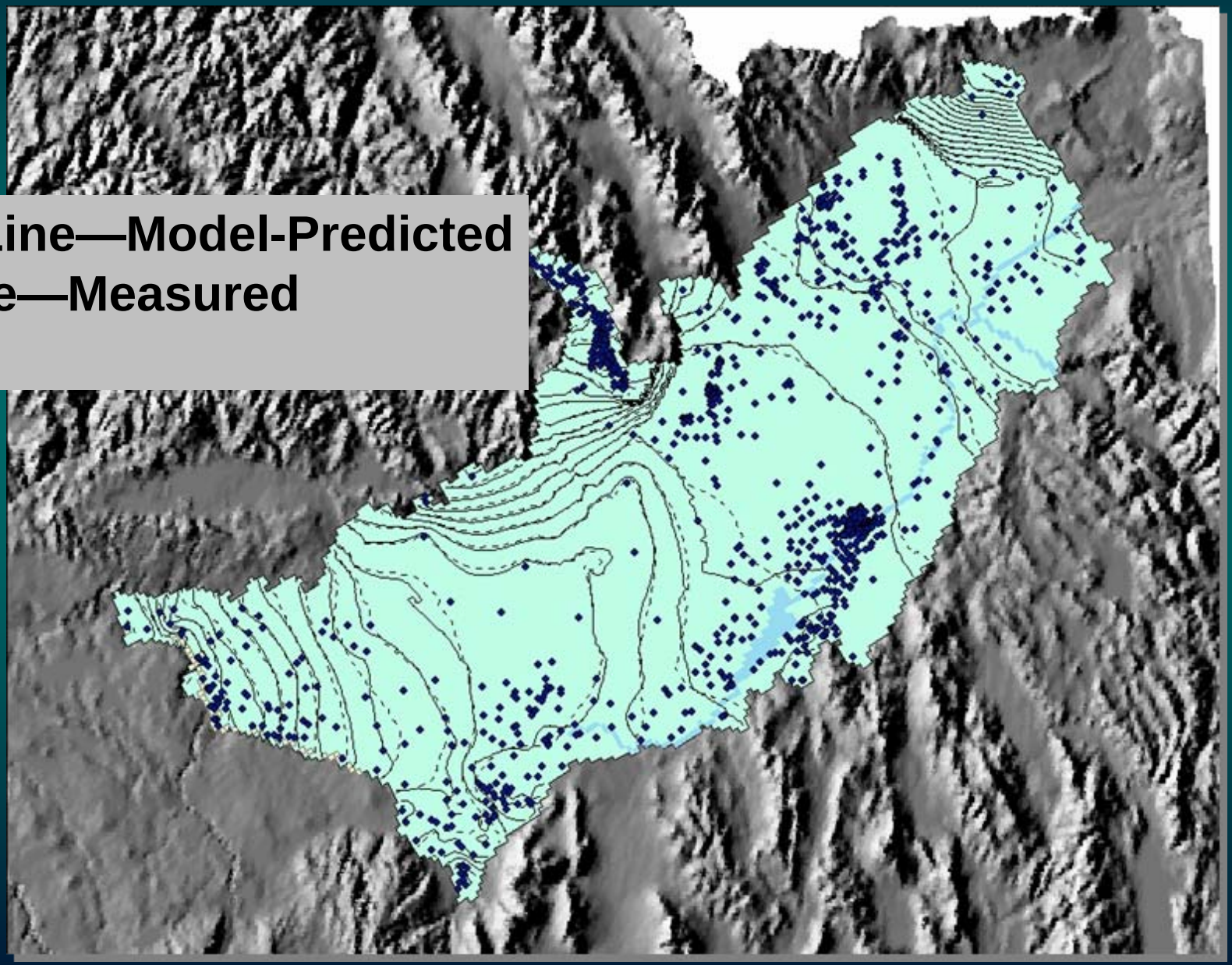


Spring Representation



Average Aquifer Water Levels
May 1, 1982 through October 31, 2000

Dashed Line—Model-Predicted
Solid Line—Measured



Unique Model Development Method

- Eastern Snake Hydrologic Modeling (ESHM) Committee Participated in Model Re-Development
  - Group comprised of experts representing various water use interests
  - Major design decisions discussed in ESHM group
  - Not always total agreement, but general consensus

- Unique method for model development
  - Attempt to gain consensus on science
- Group kept well informed through meetings and design documents
  - Approximately 30 interim reports available on IWRRI web site
- Collaboration resulted in better, more error-free model
- However, now some back-pedaling going on
  - Chips are Down

How is Model Being Used?

- IDWR Director Using Model and Other Data to Estimate Injury
- Multiple Steps:
  - Determine Water Supply
  - Estimate Water Shortages for Irrigation Season
  - Use Model to Determine Impacts From Wells During Irrigation Season
  - Threaten Curtailment if no Mitigation
  - End of Season, Adjust Numbers to Actuals

How is Model Being Used? (cont'd)

- Pretty Complex, But Considers Complexity of Water Use
  - Impacts are not Injury
  - Curtailment Only Works if you can get the Water In Current Irrigation Season
    - Otherwise Futile Call
- Actually Seemed Pretty Fair

Recent Court Ruling

- Idaho District Court Ruled the Conjunctive Management Rules Unconstitutional
- Demanded that the Director Manage Strictly Under the Prior Appropriation Doctrine
- Would Imply Region-Wide Curtailment of Ground-Water Pumping

Recent Court Ruling (cont'd)

- Ruling on Appeal in Idaho Supreme Court
- Get Out Your Dice

Some Thoughts on Conjunctive Management

- Science is Part of the Equation
- Social and Political Aspects Critically Important
  - Difficult to Handle Smoothly
  - Difficult to Keep Misinformation From Swaying Opinions
  - Parties Seem to Want to be Polarized

Some Thoughts on Conjunctive Management (cont'd)

- Snake Plain Discussion Is About Agriculture So Far
  - Species Protection Being Ignored
  - Municipal Growth Being Protested
  - Nez Perce Agreement Gained Some Ground for Species
- Very Risky to Not Consider Basin as a Whole

Some Thoughts on Conjunctive Management (cont'd)

- Societal Water Needs are Changing
- We Promote Whole Basin Management Plan
  - Stay Within Prior Appropriation (with some minor modifications)
  - Keep As Many Users in Business as Possible
  - Consider Species, Municipal Growth, Impact of Development, Water Quality

Managing changes in water budget provides opportunity for adjusting supply and demand

- Some elements out of our control
  - Precipitation
  - Tributary underflow
- Some elements can be managed
  - Consumptive use
  - Irrigation diversions, return flows, canal leakage
  - Ground-water pumping
  - Managed recharge

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- IWRRI Web Page (overview of gw/sw interactions, model, documents, scenarios, etc)
  - http://www.if.uidaho.edu/~johnson/ifiwrri/projects.html